



INNOVATING EDUCATION: THE IMPACT OF ARTIFICIAL INTELLIGENCE AND TECHNOLOGY ON TEACHING

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Abstract

This paper explores how artificial intelligence (AI) and digital technologies have been transforming teaching practices in Pakistan. Its objective is to measure the level of awareness, adoption and attitude of AI tools in education as well as identifying barriers and opportunities to integrate such tools in education. It was a quantitative approach, in which a structured questionnaire was used for data collection from 189 teachers of various level educational institutes in Pakistan. The survey focused on teachers' awareness, usage of AI technology, its influence on teaching and learning process, obstacles in using AI technology, and the future outlook. Statistical analyses were conducted using SPSS-28 and reliability was confirmed by the Cronbach's Alpha ($\alpha \geq 0.83$ for all sections). Findings were summarised using descriptive statistics and figures (bar, pie etc.). Results show that, although an overwhelming majority of educators see the value of AI in increasing student engagement (69.8% agree/strongly agree) and alleviating administrative loads (70.3%), there are still wide knowledge gaps when it comes to AI-enabled personalization (21.1% undecided). Major challenges are insufficient training (69.8% agree as barrier), cost (69.3%) and fears that a reliance on technology will damage creativity (78.8%). It is remarkable that 76.6% of the teachers have interest in PD courses to apply AI as well. The study adds to the scarce empirical inquiry on AI in Education in Pakistan and provides policy pertinent recommendations for policy makers and institutions. It raises important questions surrounding accessibility, teacher training and ethical questions about AI systems, to ensure AI does not substitute, but rather complements, human-based pedagogy. The results highlight the need to combine technological development with the achievement of social-emotional learning objectives.

Keywords: Artificial Intelligence, Education Technology, Teacher Preparedness, Digital Divide, Personalized Learning, Ethical AI

Introduction

The exponential development of artificial intelligence (AI) and digital technologies has ushered in a revolutionary period across many fields, with education standing at the forefront of this transformation (Pedro et al., 2019). The integration of AI and technology in teaching and learning processes has reshaped traditional pedagogical practices, offering unprecedented opportunities for personalized instruction, automated administrative tasks, and enhanced student engagement (Chen et al., 2020).

As classrooms evolve from physical spaces to hybrid and fully virtual environments, educators' roles are being redefined by intelligent tutoring systems, adaptive learning platforms, and data-driven insights tailored to individual student needs (Holmes, 2020). This shift is not merely a technological upgrade but a fundamental reimagining of how knowledge is delivered, assessed, and retained (Popenici & Kerr, 2017). The implications extend beyond efficiency gains, touching on core issues of equity, accessibility, and preparing learners for an increasingly digital world (Bhutoria, 2022).



The education field has witnessed a number of paradigm shifts in the past – from oral traditions in written texts, in the one-room schoolhouse to mass schooling systems and now into analogue to digital learning ecosystems (Tan, 2023). Every change has proved disruptive as well as an impetus whereas the current AI transformation is no different. In contrast to the previous technological assimilation, such as computers or the internet in classrooms, AI is the only technology that can learn, adapt, and make decisions, hence providing a more flexible and dynamic learning experience (Popenici & Kerr, 2017). Machine learning algorithms are capable of working through large ranges of data, related to the performance of students, in order to detect learning gaps, forecast future outcomes and offer student-driven solutions. Real-time language translation and conversational AI tutors are possible due to the techniques of natural language processing (NLP), thereby removing obstacles for non-native speakers and learners with disabilities (Guan et al., 2020). VR/AR technologies develop strongly immersive learning environments wherein students experience various real life settings like scientific experiments or historical re-creation so as to achieve higher level of understanding and retention.

Education has undergone several paradigm shifts from oral traditions to written texts, from one-room schoolhouses to mass schooling systems, and now from analogue to digital learning ecosystems (Tan, 2023). Unlike previous technological integrations (e.g., computers or the internet), AI possesses the unique ability to learn, adapt, and make decisions, enabling a more dynamic and responsive learning experience (Roll & Wylie, 2016).

Machine learning algorithms analyse vast datasets on student performance to identify learning gaps, predict outcomes, and recommend interventions (Mavroudi et al., 2018). Natural language processing (NLP) facilitates real-time language translation and AI-driven tutoring, breaking down barriers for non-native speakers and learners with disabilities (Guan et al., 2020). Meanwhile, virtual and augmented reality (VR/AR) create immersive environments where students can simulate scientific experiments or historical events, deepening comprehension and retention (Lin et al., 2023).

Artificial Intelligence holds promise for democratizing education, particularly in regions with teacher shortages or limited resources (Pedro et al., 2019). Adaptive learning platforms like Carnegie Learning and Squirrel AI have demonstrated efficacy in improving student outcomes by adjusting content difficulty in real time (Zhou, 2021). Automated grading systems also reduce administrative burdens, freeing educators to focus on mentorship and interactive teaching (Chen et al., 2022). However, these advancements raise critical ethical questions about data privacy, algorithmic bias, and the potential erosion of human-centric education (Nguyen et al., 2023). Critics warn that overreliance on AI may diminish the empathetic, creative, and ethical dimensions of teaching qualities integral to holistic student development (Lecce, 2024).

The capability of AI to democratize education is also quite impressive. In areas where there is a teacher shortage or insufficient resources, AI-enabled platforms can create high-scale and high-quality instruction; thus, inequalities in location and class won't bar access to knowledge (Pedro et al., 2019). Some examples of adaptive learning systems include Carnegie Learning and Squirrel AI, which have proven to be very effective in enhancing students' performance because the difficulty of content keeps changing depending on the performance of the learners. In the same way, automated systems of grading reduces the administrative burden on educators hence they have more time to commit on mentorship and interactive teaching (Chen et al., 2020). Moreover, although such technologies have been adopted so widely, there are emerging imperative questions concerning data privacy, algorithm bias, and the personalization of education. However, critics opine that too much reliance on AI might undermine the human aspect of teaching; the empathy, the creativity and moral guiding that make up the whole algae of human development (Lecce, 2024).

Furthermore, the introduction of AI into the education system requires a reconsideration of priorities in curricula and methods of teaching and learning. As automation and AI take over every day cognitive functions, the role of education needs to change and develop superior ways of thinking, emotional intelligence, and digital literacy (Holmes, 2020). The World Economic Forum's Future of Jobs Report points to increased focus on such skills as critical thinking, problem-solving, and adaptability – abilities challenging to replicate by AI. Therefore, educators have to switch their roles from primary knowledge providers to promoting experiential, collaborative and lifelong learning (Fitria, 2023). Professional development programs need to



empower teachers with technical competence and strategic intuitions to put AI tools to good use without undermining their indispensability in promoting the well-being of the students and ethical reasoning (Nguyen et al., 2020).

That is the societal implication of AI in education is also quite massive. With AI systems playing an important role in shaping career guidance, determining university admissions, and preparing the work force for employment, the design and application of these systems must be examined for fairness, transparency, and accountability (Roll & Wylie, 2016). The digital divide is still a prevalent problem, with poor communities not having the infrastructure and capabilities of achieving the benefits of technological leaps. It is important that policy makers, educationalists and technologists work together to make sure that AI becomes an equalizing agent and not an enhancer of the existing inequalities (Sumo & Bah, 2021). International frameworks and ethical guidelines like UNESCO's guidelines on AI in education enable the consideration of a balancing aspect between innovation and inclusivity in an ideal basis.

This research article covers the multi-dimensional effects of AI and technology on teaching and the transformative potential, as well as the critical challenges that go with this shift. An analysis of the existing trends, case studies, and empirical evidence are used during the research to outline overall understanding of how AI is transforming the paradigms of education (Seidel & Perez, 2013). It examines the effectiveness of AI-powered tools in improving learning outcome, changing roles of educators, and ethical aspects that must be considered in future development. What is more, the article provides policy recommendations and best practices for harvesting the benefits of AI while reducing its risks (Chen et al., 2022). Reviewing the process of evolution of the educational landscape, this research emphasizes the necessity of a human centred approach which consonants the technological advances with the values that are timeless – equity, empathy and intellectual growth.

The sense of urgency regarding this inquiry is supported by the rapid rate of progress in AI development that continues to dominate the global education systems. The pandemic of COVID-19 was a catalyst for digital transformation that revealed the promise and the perils of technology-mediated learning (Haque et al., 2023; Laszlo et al., 2017). While AI-powered platforms provided continuity in education in school closures, it had also made evident disparities in access and the incomparable worth of face-to-face engagement (Islam et al., 2025; Serdyukov, 2017). In the wake of post-pandemic recovery of institutions throughout the world, the lessons must be used to implement a more resilient and inclusive approach to the integration to AI in education (Afshar & Shah, 2025). Following the ongoing discussion, this article compiles interdisciplinary views offered by science education, computer science, ethics, and policy studies, suggesting a complicated path for the stakeholders concerned about the future of teaching and learning (Chassignol et al., 2018).

Ultimately, the aim of this research is not to promote the adoption of AI in a naive manner but to encourage the conversation on the role of AI in education that will be neither supportive nor hostile. In a critical analysis of successes, failures and emerging trends, the study intends to empower educators, policymakers and technologists to make informed decisions for the success of the student and well-being of the society. The crossover of AI and education is one of the major opportunities of and, at the same time, cause for responsibility during the turbulent 21st century, requiring in-depth consideration and joint efforts to take advantage of innovation to benefit society as a whole. While we are at the verge of a new era in education, this article is aimed at showing the path ahead, where technology compliments, and does not replace the human aspect of teaching.

Problem Statement

Integration of artificial intelligence (AI) and digital technologies in the sphere of education comes with never-before-seen opportunities and challenges. Whereas these innovations offer personalized learning experience, efficiency and broader access, unregulated adoption of these innovations threatens to aggravate existing inequalities in education. Major issues are digital inequality gap, ethical conflicts related to privacy of data and the bias algorithms, and the exclusion of educators from decision-making. Besides, there is the risk of eroding so crucial thinking and socio-emotional skills in students through too much reliance on AI-driven tools. Absent the broad policy frameworks, fair infrastructure, and programs for the retraining of



teachers, these technological breakthroughs may cement the systemic disparities instead of promoting inclusive high-quality education. These challenges call for immediate interdisciplinary research, stakeholder collaboration, and evidence-based tactics to ensure that AI is utilized as an enabler and not an exclusion platform in the global education systems.

Objectives of the Study

This research is aimed at critical examination of impact of artificial intelligence (AI) and emerging technologies on modern education from factors that are both opportunities and challenges. The specific objectives include:

1. To determine the performance of AI-driven tools (including adaptive learning platforms, intelligent tutoring systems and automated grading) in terms of imparting student engagement, retention and academic success.
2. To assess changing role of educators in AI-powered classrooms, a change in pedagogical functions, ways in which teacher and student roles will change and professional development needs.
3. To determine ethical and societal issues such as data privacy threats, algorithmic bias, and digital divide that are a result of implementation of AI in education.
4. To examine some of the top barriers, preventing AI adoption, such as lack of training, cost barriers, and worries about over relying on technology.

Significance of the Study

This work is of critical importance to educators, policymakers, and institutions in determining their courses of action while adopting AI and technology into education. Making an assessment of the educators' awareness, use, and perceptions, the study offers practical insights into the advantages and difficulties of AI-based teaching tools. It shows the areas of institutional gaps, training needs, and cost barriers while providing a blueprint for equitable implementation. Besides, the findings will guide professional development programs in order to increase digital literacy among teachers.

For policy makers, the research highlights the need for having ethical guidelines and infrastructure investments in order to discourage cases of disparities in technology. In a world with AI redefining global education, this research plays a role in providing the balanced and human-focused approach to the process, where innovation strengthens learning, without caging the creativity and dynamics between teachers and students within technological frameworks. Finally, it contributes to sustainable education transformation in the context of Pakistan among others.

Literature Review

A literature review is a critical review of existing literature, theories, and scholarly work on a particular subject, pointing out lacunas, trends, and important debate. It integrates previous knowledge to relate new research to the existing reality and argue for its necessity as an extension to the existing scholarly discussion.

Introduction to AI and Technology in Education

The introduction of Artificial Intelligence (AI) and digitisation in education has changed the old ways of teaching and learning. With AI identified as the simulation of human intelligence in machines, there is possible to have adaptive learning, automated assessments and personalized instruction (Bhattacharjee, 2024). At the same time, educational technologies learning management systems (LMS), virtual classrooms, AI-driven tutoring systems, etc. have improved access to quality education and changed the course of pedagogical strategies (Al-Zahrani & Alasmari, 2024). This review of literature explores AI in education, its pedagogical advantages and disadvantages, ethics, and the future possibilities based on empirical studies and theoretical models.

Historical Evolution of AI in Education

The utilization of AI in education could be dated back to the 70s with the earliest Intelligent Tutoring Systems (ITS) such as SCHOLAR, which promoted personalized learning (Kelkar, 2022). The 21st century witnessed the great breakthroughs with use of adaptive learning platforms that use machine learning to personalize learning content for students (Arshad et al., 2024). The spread of the COVID-19 pandemic provided additional momentum to the emergence of the EdTech industry in which the use of AI plays a prominent role in distance learning (Lin et al., 2023). Nowadays, applications of AI start from automated



grading pass to predictive analytics, to virtual teaching assistants, signalling the move from teacher-centred to learner-centred models (Mavroudi et al., 2018).

AI and Personalized Learning

Personalization of learning experience is one of the major benefits of AI in education. Adaptive learning algorithms review student performance data to revise the learning content accordingly in real time, addressing the individual learning deficits (Nefediev et al., 2019). Researches demonstrate that AI-controlled platforms enhance engagement and retention capacities as they offer personalized feedback and pacing (Bilic et al., 2023). For example, Carnegie Learning's AI-based math tutors have shown large learning gains in K-12 classrooms (Zhou, 2021). However, critics warn there is a risk when relying on AI, such as the likelihood of less human interaction, whereas it is fundamental in socio-emotional development (Comstock, 2024).

Enhancing Teaching Efficiency through AI

Artificial Intelligence reduces administrative workload, by grading assignments and attendance, and creating advanced teaching content which gives teachers more time for advanced teaching tasks. Plagiarism detection and writing support services such as Turnitin and Grammarly facilitate this process, with chat-bots handling frequently asked questions from students (Ullah et al., 2024). Research supports that AI takes the burden off the teacher but concerns of job loss and the devaluation of human knowledge remain (Yinping & Yongxin, 2023).

In order to do that professional development and training need to take place continuously so that teachers do not become side-lined in the learning process (Ma & Lei, 2024).

Challenges in AI Adoption

Artificial intelligence has potential for education, yet barriers exist to its widespread use. One large issue is the digital divide, or unequal access to technology that exacerbates extant educational inequalities (Ullah et al., 2024). Moreover, ethical issues of privacy, algorithmic bias, and surveillance risks are serious dilemmas (Afshar, 2023; Qu et al., 2022). Additionally, a fear of or lack of experience with such tools leads to many teachers being averse to integrating AI (Bhutoria, 2022). Moreover, expensive implementation routes stifle the availability of AI-based solutions to low-resource organizations (Zaurez Afshar & Hussain Shah, 2025; Nguyen et al., 2023). To address these challenges, policymakers will need to focus on issues such as how best to train teachers, allocate resources, and create ethics of responsible AI in education (Ahmad, 2024).

Ethical and Societal Implications

The effects of AI in education are not just limited to teaching and learning; they also shaped ethical and social concerns. Bias in AI-driven systems can have lasting effects, particularly for disadvantaged students. In addition to this, the collection of student data raises privacy concerns of its own, especially due to regulations such as GDPR and FERPA (Chen et al., 2022). To tackle those challenges and mitigate the risks, some researchers advocate the need for transparent AI development, representative datasets, and strong governance (Ullah et al., 2024).

The literature emphasizes AI's disruptive potential with implications for education, and raises key challenges. A successful integration requires nuance a balance between AI's efficiency and what we know is coproduction of equity, ethics, and the human part of teaching. In any case, future research should address longitudinal effects of AI on learning performances and teachers' roles to guarantee a sustainable and inclusive innovation in education.

Research Methodology

The study was designed in a quantitative research to explore the influence of AI and technology in Pakistan's teaching practices. A convenient sampling technique was used to collect the data from 189 teachers of Pakistan's different educational institutions. The sample participants were from an intersection of sociodemographic characteristics: gender, age, teaching experience, and institution size (public/ private university). A structured questionnaire was prepared to get the data with respect to awareness, usage, impact, constraints and future of AI and technology in education. The questioner consisted of four parts: Awareness and Utilization of AI and Technology in Teaching, Perception on AI's Impact on Teaching and Learning, Challenges and Future and personal Information.

The instrument's reliability was verified using Cronbach's Alpha, which showed a high internal



consistency for all the parts. The reliability of the results was found to be quite high with 0.85 for Awareness and Usage, 0.83 for Perceived Impact and 0.86 for Challenges and Future Prospects. The reliability of the questionnaire as a whole was 0.84 which validated its strength for data collection.

Statistical analysis was performed using SPSS-28 and frequencies and percentiles were used to present all sections of the responses. Results were illustrated graphically as bar graphs, pie charts, donut charts and tables to facilitate greater clarity and interpretation. For example, some demographic information (gender, age, years of teaching, type of institution) were displayed using figures, and agreement to each item (rated on a Likert scale) was summarized in tables.

The research was carried out following ethical guidelines where participants remained anonymous and participated voluntarily. Prior to data collection, informed consent was obtained, ensuring that all respondents understood the study's objectives, their right to withdraw at any time, and the confidentiality of their responses. Ethical approval was secured from the relevant institutional review board to uphold principles of integrity and minimize potential risks (Ahmad, 2024). The methodological approach combined quantitative analysis with demographic profiling, resulting in a holistic insight into teachers' beliefs regarding AI and technology in education. By employing a structured questionnaire with validated reliability (Cronbach's $\alpha > 0.80$), the study ensured robust and interpretable findings (Butt & Yazdani, 2023).

Reliability of the Instrument

The Alpha test is a technique that is used to measure reliability of a questionnaire by examining the data obtained as a result of different tests. Cronbach's Alpha, which is a common statistical measure, is used to judge the internal consistency of a measuring instrument. Cronbach's Alpha (Butt & Yazdani, 2023) is an authentic process to gauge the precision and trustiness of a questionnaire, assuring that the acquired data is devoid of errors and prejudices. This method facilitates identifying if the questionnaire items are consistently measuring the same thing. To compute the alpha values, the method of (Butt & Yazdani, 2023) are adhered to the alpha value gives a range that indicates the reliability of the questionnaire. The interpretation for these scores is: $\alpha > 0.9$ excellent, $\alpha > 0.8$ very good, $\alpha > 0.7$ good, $\alpha > 0.6$ acceptable, and $\alpha > 0.5$ dubious, and $\alpha < 0.5$ unacceptable. The a priori reliabilities of the variables were ($\alpha = 0.85$; $\alpha = 0.83$; $\alpha = 0.86$), confirming therefore the questionnaire to be reliable.

Table 1

Cronbach's Alpha Reliability Results

Section	No. of Items	Cronbach's Alpha (α)	Reliability Level
Awareness and Usage of AI and Technology in Teaching	5	0.85	Very Good
Perceived Impact of AI on Teaching and Learning	5	0.83	Very Good
Challenges and Future Prospects	5	0.86	Very Good
Overall Questionnaire Reliability	15	0.84	Very Good

Results

Results refer to the key findings and outcomes derived from data analysis. In this study, they demonstrate the measurable effects of AI integration in educational settings.

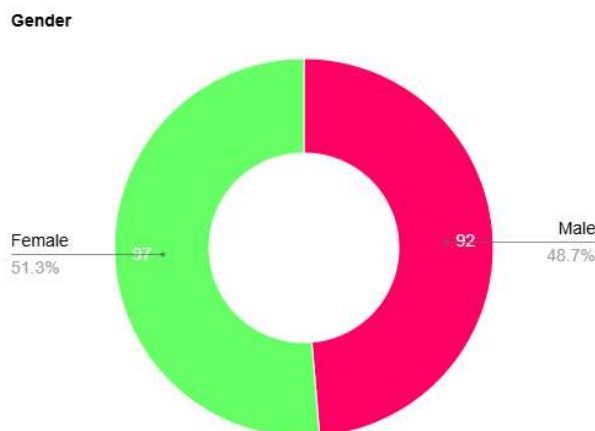
Demographic Information

The data provided show the gender breakdown of individuals completing a survey. Of the participants, 92 are male and 97 are female.

This reflects a marginal overrepresentation of females (97) vs. males (92), which depicts a nearly balanced representation of genders in the sample. This MINOR variation might be something anyway of interest when the survey is looked at in terms of gender-specific responses. It is worth mentioning that, although the sample is fairly homogeneous, the total quantity of cases (189) presents a concrete albeit small preference for women participation.



Figure 1
Age of the Respondents



The information could also be valuable for analyses of possible gender-related effects, e.g. when the genders of the respondents may affect their attitudes or experiences related to the topic investigated in the survey.

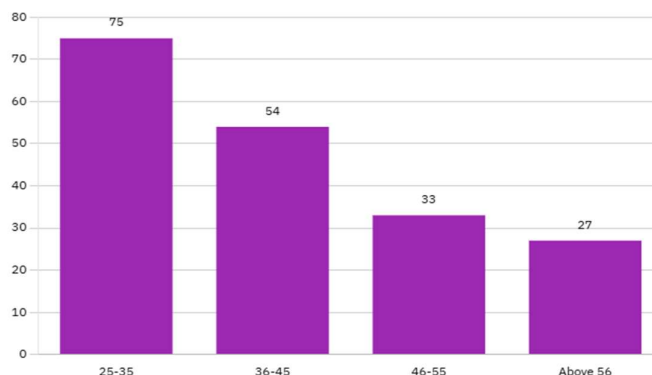
Age

The information provided reflects the age of the survey respondents, thereby giving a snippet of the demographic profile. 25 year old are the majority, with 75 people. This implies that a substantial proportion of the respondents are younger adults, who might be more actively involved in the issue, or familiar with the subject of the survey. The second largest age group, comprised of 54 respondents aged 36-45. And while this is relatively few when compared to the 25-35 set, it's nonetheless a significant chunk of all respondents. The involvement of this cohort shows that middle-aged adults are also interested in the topic, but the number is less than in younger generation.

The age group of individuals aged 46-55 years contains 33 individuals who also reveal a decrease in the number of participants as the age continues to increase. This pattern indicates that perhaps older population in the age range is not as involved or represented well in the survey due to (multiple) confounding reasons of priority, interest or technology related mismatch.

Finally, the Above 56 group has 27 samples, which is the minority in the sample. Less participations from users older than 56 years of age might suggest that older people are less engaged or interested in the topic, something that could depend on factors such as ICT proficiency or generation-related habits.

Figure 2
Age of the Respondents



On the whole, the data presents a youth-centric response distribution per younger adults (25-35) have made the most responses to the survey. As the respondent is older, the participation decreases, implying age as one of the factors affecting the survey participation level. This could have implications for content or



outreach criteria (based on how age groups access or engage with the content being investigated).

Teaching Experience

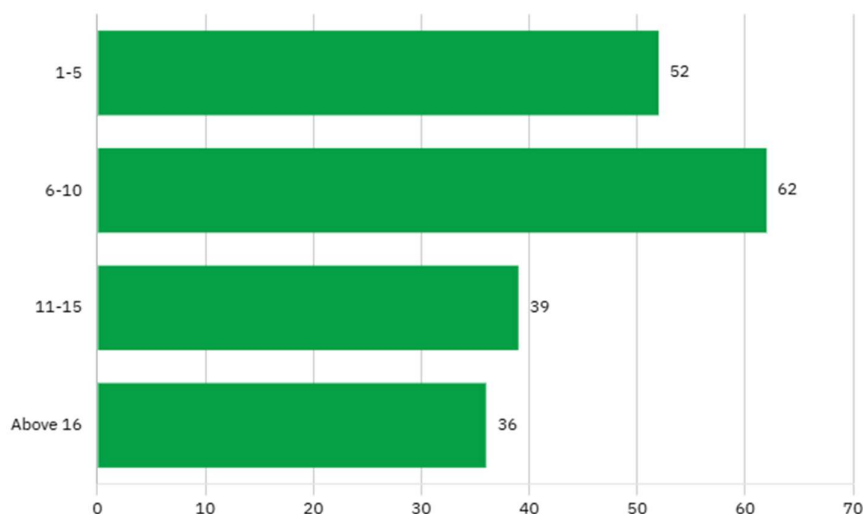
Respondent distribution by number of years teaching is shown and reflects the variance in the demographics of the survey respondents.

The 6-10 years' teaching experiences category Scores in this category peaked, with 62 participants. This suggests that most of the respondents have a medium level of experience and that they may have developed good knowledge of classroom behaviour and teaching. This cohort may provide a perspective that integrates both early career experiences and the evolution of increasingly sophisticated teaching methods over time. The 52-part group with the next largest number of members is the 1-5 year teaching experience part. These respondents are also newer to Law, perhaps providing a fresh perspective and a little bit of 'buzz'. They may have faced difficulties adjusting to the tech and coming to grips with what makes for good teaching in an online space, challenges from which younger colleagues might learn how best to support recently minted educators.

Then, 39 respondents have an experience of teaching for 11-15 years. Teachers belonging to this type are probably more experienced: They have developed more specialised knowledge in particular subjects or pedagogies. They can offer useful suggestions for the implementation of new technologies, by attempting to strike a reasonable balance between old and new educational tools. Finally, the smallest sample in the data set is of 36 volunteers with over 16 years of teaching experience. These teachers are seasoned and experienced, and have watched the educational field change drastically over the years. Their views on the development of education (which includes issues such as AI and technology) are informed by a lot of time in the trenches, and probably tend toward the long view of how the profession has changed over time.

Figure 3

Teaching Experience of the Respondents



On average, the results show a mixed range of teaching experience for the participants, but somewhat skewed towards moderate level of experience (6-10 years of teaching). This variation is an important aspect, because it captures the diversity of experience that can affect the degree of adoption and perception of technology and AI in education. Both sets have some unique tips in terms of where you are in your career, so you get the well-rounded perspective.

The distribution of the respondents according to university sector is presented in the data hereof with the different participants at the public and private university level.

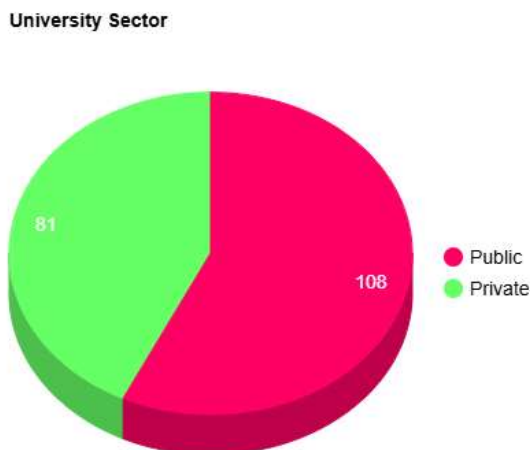
The biggest group of respondents are 108 persons from the state sector (Higher Education Institute), so we have taken more participants with reference to public university. This overrepresentation could indicate that there are more public universities, or that faculty in public universities are more likely to complete



surveys of this type. For example, there may be significant differences in how public sector respondents consider and take advantage of educational technology and AI, compared to private organizations – based on available resources, budgets, and administrative backing and they may represent more variation in the sample population.

Figure 4

University sector of the Respondents



In contrast, the number of respondents from the private sector is 81, which is less than the public sector. Nevertheless, the reactions from private sector educators are notable. This data also indicates that private universities, which are fewer, may have other focuses or difficulties related to adopting technological innovations for education. Private colleges, for example, may have tighter budgets, but could also be more nimble in implementing new technologies because of a smaller, elite-focused decision-making bureaucracy.

On the whole the data indicates a significant over representation of respondents from public universities, and a slighter over representation of those from a private university. Such distribution reflects possible variations in institutional features and educational background impacting in the use of technology and AI in the classroom. Understanding these differences by sectors is important for the customization of educational technologies and the addressing of sector-specific challenges in AI integration in the teaching and learning process.

Section B: Awareness and Usage of AI and Technology in Teaching

The scale used is Strongly Disagree (1), Disagree (2), Undecided (3), Agree (4), and Strongly Agree (5).

Table 2

Awareness and Usage of AI and Technology in Teaching

No.	Statement	1	2	3	4	5
1	I am aware of how Artificial Intelligence (AI) is being used in education.	10	20	30	70	59
2	I regularly use educational tech tools (e.g., LMS, Zoom, Google classroom)	15	18	30	75	51
3	I understand how AI can personalize student learning experiences.	12	28	40	66	43
4	I feel confident in using technology to support my teaching.	8	17	34	73	53
5	My institution encourages the use of AI-based tools in the classroom.	7	14	32	78	58

The findings in Section B of the questionnaire, which deals with the awareness, and usage of AI and technology in teaching systems indicate interesting aspects of how teachers see and use technology in the teaching environment.

Most participants agree (37.0%) or strongly agree (31.2%) that they know how AI is being applied in education. This indicates there's a substantial chunk of teachers who appreciate what AI does in education. Nevertheless, 5.3% strongly disagree and 10.6% disagree, which means there is a minority of teachers who do not know or are less knowledgeable about the application of AI in the educational context. This reveals a



space in educational establishments where more consciousness-raising projects can be conducted.

A majority of teachers agree (39.7%) or strongly agree (27.0%) that they often use technology tools for education, such as LMS, Zoom, and Google Classroom. This mirrors a larger movement to incorporate digital components in classrooms and teachers embracing new ways to teach. But 7.9% “strongly disagree” and 9.5% disagree, leaving a relatively large percentage of educators who are not using these technologies in their teaching to their full extent, for reasons including lack of equipment or training or preference of traditional teaching methods.

In terms of the perception of AI’s ability to personalize student learning, a large portion of teachers agree (34.9%) or strongly agree (22.8%). In the meantime, 6.3 percent “strongly disagree” and 14.8 percent “disagree,” so there seems to be some confusion still over how AI can be a useful tool for creating individualized learning experiences for students. Given a large number of undecided (21.1%) responses in Durak—could not tell us it means the respondents could have had the least exposure and knowledge on the capabilities of AI in education.

The data shows that educators are generally confident (38.6%) or very confident (30.2%) in using technology in their teaching. This is a good reflection of use of technology in the classroom. Nevertheless, 4.2% disagree strongly, and 9.0% disagree suggesting that some teachers may still have a lack of confidence, or may find it difficult to adjust to teaching new technologies. 18.0% of the ‘undecided’ feedback may suggest some teachers lack confidence in their competence to use technology for their instruction.

With regard to the assertion regarding institutional support for the use of AI-based tools, we found that about 41.3% of teachers agreed, while 30.7% strongly agreed their institution supports the use of AI tools in teaching. This is an encouraging sign of academia’s growing acceptance and support of AI for education. 3.7% strongly disagree and 7.4% disagree, a small percentage of teachers who may feel unsupported or unsupported by their institutions and incorporating the AI tool.

Taken together, the data indicates that even though many educators are cognizant of AI and are incorporating EDU technologies in their classes, there are key areas where knowledge around how AI can enable personalized learning is lacking, and where confidence with technology can be enriched. Institutions’ strong push on AI tools suggests educators are being positively encouraged to adopt those tools, although there are opportunities for better preparation and more options for resources. Second, the number of respondents who did not provide an opinion identifies knowledge gaps where more tailored information or training might be most needed.

Finally, this section indicates in general a positive perspective towards AI and educational technology, with room for improvement in knowledge acquisition and confidence enjoined especially by those educators who still reserve or have doubt concerning the potential of these technologies in education.

Section C: Perceived Impact of AI on Teaching and Learning

The scale used is Strongly Disagree (1), Disagree (2), Undecided (3), Agree (4), and Strongly Agree (5).

Table 3

Perceived Impact of AI on Teaching and Learning

No.	Statement	1	2	3	4	5
1	AI can enhance student engagement and learning outcomes.	10	22	25	60	72
2	Technology has made teaching more efficient and effective.	8	17	30	72	71
3	AI reduces the burden of repetitive tasks like grading or content delivery.	6	12	38	70	63
4	Students learn better, when AI tools are used for personalized learning.	7	14	34	74	60
5	AI and technology have transformed the traditional role of the teacher.	5	10	36	78	60

The responses from Section C of the questionnaire assess the perceived effects of AI on teaching and learning. The responses help highlight how teachers are viewing AI and technology as a disruptor or change agent in the classroom. Slightly more than half (31.7% agree and 38.1% strongly agree) of respondents believe that AI can help increase levels of student engagement and improve learning outcomes. This indicates good confidence of educators on the benefits of AI for learning by students. But 13.2 per cent are still unsure, and



5.3 per cent strongly disagree. The relatively high concordance rate is consistent with the increasing appreciation of AI as a tool to enhance engagement and academic effort.

Contrary to the above assertion, a significant number of educators either agree (38.1%) or strongly agree (37.6%) technology has simplified and enhanced instruction. This echoes the widespread attitude that tech tools, AI included, can automate administrative and teaching duties. 9.0% disagree and 4.2% strongly disagree (Approx.9) suggesting that a small percentage of educators may not feel that technology has greatly enhanced the effectiveness of their teaching. The 15.9 per cent undecided responses suggest there are teachers who are in the process of considering the effect of technology on their teaching practices.

The majority of answers are also positive regarding whether work is relieved by AI in repetitive tasks (37.0% agree, 33.3% strongly agree). This suggests that AI is perceived as a vehicle which can allow teachers to save time and concentrate on tasks that are perceived as being more beneficial by automating routine tasks, such as grading and delivering content. But there's still a hefty 20.1% who aren't sure, which could be an indication that they're also teachers who don't fully rely on AI tools or have limited exposure with them. The other side are 3.2% who strongly disagree and 6.3% who disagree, meaning a minor part of teachers does not perceive AI as a help to ease their workload. Nearly seven in ten respondents agree (39.1%) or strongly agree (31.7%) that students learn better with AI-enabled tools that support personalized learning. These results may reflect the growing awareness of the potential of AI to serve the unique learning needs and desires of individuals. However, a remaining 18.0% are currently undecided, which could be a reflection that some teachers are unsure about how effective AI is in personalising education, or simply need more time being exposed to tools powered by AI. Just 7.4% disagree and 3.7% strongly disagree, meaning a clear majority of educators recognise the possibility for AI to drive personalised learning.

Most teachers agree (41.3%) or strongly agree (31.7%) that AI and technology have changed what it means to be a teacher. This indicates that the teachers understand technology, especially AI to be a force with the potential to remould their approach to teaching and what they are able to do in the classroom. But 5.3% strongly disagree, and another 2.6% disagree, meaning a small fraction of teachers are down on the impact of AI and tech on their jobs. In the alternative, for an additional 19.0%, it is that they do not know and this may be indicative of uncertainty as to how their position has changed, or the extent of that change.

The results indicate that most educators think positively of AI and technology, especially in enhancing student engagement, promoting instructional efficiency, and decreasing the amount of repetitive work. It is likewise widely accepted among educators that AI-driven personalized learning can boost student performance. However, there are clear undecideds in the replies to all the statements which suggests that some teachers might still be considering or weighing up the consequences of AI on their own teaching.

The findings in the roundtable represent the rise in awareness of the power of AI in education, although there continues to be a portion of educators that are sceptical or who haven't yet seen AI to its full extent as a tool for their learners.

Section D: Challenges and Future Prospects

The scale used is Strongly Disagree (1), Disagree (2), Undecided (3), Agree (4), and Strongly Agree (5).

Table No. 4

Challenges and Future Prospects

No.	Statement	1	2	3	4	5
1	Lack of training is a major barrier to implementing AI in my teaching.	8	18	31	72	60
2	There is a risk that over-dependence on technology could harm student creativity.	4	11	25	76	73
3	AI tools are too expensive or inaccessible in my university.	6	12	40	75	56
4	I am interested in receiving professional development in AI and EdTech.	3	9	32	85	60
5	AI will play a significant role in the future of higher education in Pakistan.	2	7	30	80	70

The content in Section D of the questionnaire provides an analysis of how teachers experience the barriers related to the implementation of AI in education and the future of AI in education. The answers shed a light on any roadblock such as training, budget, future perspective on AI impact for higher education.



Many educators agree (38.1%) or strongly agree (31.7%) that a lack of training is a major barrier for them when implementing AI in teaching. This speaks to how teachers across the board say they require further professional development to be able to thoughtfully incorporate AI tools in their classrooms. But 9.5% disagree and 4.2% strongly disagree, suggesting that a minority of teachers may feel trained enough or do not view training as a significant barrier. The 16.4% undecided's answer shows that some of the teachers may not yet be sure of whether or not the training issue was a major obstacle or are in a confirming phase in their own institutions.

A majority of teachers agree (40.2 percent) or strongly agree (38.6 percent) that students' overreliance on technology is harming their creativity. This is an expression of a frequent worry amongst teachers for the danger of an excessive use of technology at school. The 13.2% of undecided answers suggests that some teachers do not yet have an opinion or require more information concerning technology's impact on creativity. The 5.8% disagree and 2.1% strongly disagree indicates that there are some teachers who do not think technology represents a risk to creativity, and may see it as a support which enhances creativity, not squashes it. The answers here show that 39.7% agree and 29.6% absolutely agree and that AI tools are too expensive or unattainable in their universities. This is a high price in the way of AI adoption; in particular, in the case of public universities (that often need this technology more), where the budget can restrict technologies. The 21.1% undecided represents some uncertainty or variation between accesses across different schools. Besides, 3.2% strongly disagree and 6.3% disagree, indicating that the AI tools are affordable or available in their institutions to only a few educators.

A large majority of teachers are interested in AI and/or Ed-Tech-based PD, as 44.9% agreed and 31.7% strongly agreed. This suggests a real appetite for more training in these areas, and that teachers understand AI and Ed-Tech's potential but may feel ill equipped. Current undecided responses of 16.9% indicate that even though many teachers are open to development options or opportunities, they do not have a good handle on what type of training they need or that exists. Those 1.6% who are strongly disagree and 4.8% who disagree represent a relatively small group of education leaders who do not report any interest in additional professional development.

High hopes for AI in the future of higher education in Pakistan (agree 42.3% and strongly agree 37.0%). All of this suggests that the educator community sees AI becoming a routine part of higher ed—innovating at all our institutional efforts to reach learners in different ways, at different times, and in different places. Another 15.9% are not sure, suggesting uncertainty about the timing or extent of AI's future impact. Only 1.1% strongly disagree and 3.7% disagree, indicating that very few teachers have any scepticism about AI's role in the future of higher education.

The findings in Section D shows both threats and prospects for adoption of AI in education. While there are widespread challenges such as inadequate training and AI tool cost, there actually is a high level of interest in professional development around AI, and optimism in the future adoption of AI as an educational solution. The worries people have over how tech-dependent students are impacting how creative they can be illustrates the trade-off that educators must make between the introduction of AI and maintaining the traditional mode of teaching. Collectively educators are optimistic about AI, but they also acknowledge that training and accessibility, among other obstacles need to be addressed in order for AI to become an effective tool for learning. There are challenges but most educators are optimistic about the future role of AI and want to be trained so it can be harnessed to come to bear on how to make teaching and learning better.

Discussion

The pervasiveness of AI in education has brought about a major change in the teaching-learning model and the teacher's role. As suggested by the findings, AI offers the promise to improve student engagement and learning outcomes through personalized learning experiences especially when adaptive learning technologies are employed. AI and the possibility to personalize educational content to the individual student's needs not only promotes academic success, but also increases the chances of keeping the student in school through interventions tailored to meet their needs (Wei & Qi, 2024). But as much as it's clear the advantages of AI-enabled platforms, so is the need to recognize the challenges that come with their use including issues related to data privacy and algorithmic bias. The dependency on machine-based decision making in the educational



setting raises important ethical considerations that should be addressed in order to promote fairness and inclusiveness in AI use.

Among the main concerns raised in the studies is the digital divide that tends to reinforce educational disparities. The results indicate that while AI has the capacity to democratize education, especially in areas that suffer from a scarcity of trained educators or materials, differential access to technology is still a significant impediment (Xu & Margevica, 2021). Public or private organizations, particularly in developing countries, have financial difficulties for acquisition of AI technologies. Moreover, although support for AI is strong, there is a huge discrepancy in teachers' readiness. Theme 3: Sole reliance on AI will put the humanity back facing in the education process. In line with our discussion under the second theme on the creativity and ethics of educators in the AI era, numerous participants felt that they need professional development around AI that will also focus on the importance of the human touch and ethics in education (Yuwono et al., 2024). For any AI deployment, it is essential to have associated teacher training programmes that enable teachers to use technology in a way that does not dilute the fundamental components of the education process, including creativity, empathy and the development of critical thinking.

Given these fears, the study also serves to inform educators about their evolving role in AI-infused classrooms. AI and automation can handle the administrative parts of teaching, such as grading and even delivering content, freeing up human time for more personal interaction (one-on-one, small group, projects, etc.), but we must be careful not to remove the human from teaching. The emotional and intellectual 'heart' teachers possess are irreplaceable by AI, and children would lose hard-won socio-emotional skills from spending too much time behind screens (Xiong, 2022). This changing face of the teacher brings with it a need to reconsider teaching methods and put more emphasis on team-work, experiential learning and the acquisition of soft skills, things AI can't readily reproduce. According to the study, the future of education will depend on teachers to balance technology with traditional pedagogical tools that support the development of the whole student.

In the future, this research recommends a user-centred introduction of AI in education. It is not just an embracing of technology, but an effort to keep equity, empathy, and intellectual growth at the nucleus of education. Ethical frameworks 'Any AI used in education should adhere to strong, internationally acceptable ethical guidelines which focus on student well-being and societal fairness. "As we watch AI continue to unfold at an accelerated pace, it is imperative that policy makers, educators, administrators and technologists work together to develop systems and practices that promote the best that AI has to offer while tamping down the its challenges. It is only through interdisciplinary collaboration that we can harness the potential of AI as a tool for education in an inclusive and sustainable way which levels the playing field for all students, regardless of their socio-economic status.

Conclusion and Recommendations

The emergence of AI and digital technology in education marks a transformative era in academia redefining traditional pedagogical approaches, while offering new possibilities for personalized learning, administrative effectiveness, and increased student engagement. When 189 teachers from various educational organizations of Pakistan took part in this study, it demonstrates the transformation effect and the challenges of adopting AI in education. Results indicate that a high percentage of teachers are familiar with the applications of AI and they use technology tools such as LMS, Zoom, and Google Classroom during their teaching process. Yet, there is not yet a full understanding of how AI can individualize learning experiences and to this day some educators are hesitant to effectively use such tools.

Among the inferences, the optimism towards the influence of AI on teaching and learning is one of the key takeaways. More than half said AI helps to engage students, produce better learning outcomes, and makes common tasks such as grading less of a hassle, with teachers able to dedicate more energy to mentorship and interactive teaching. However, challenges including the digital divide, expensive AI solutions and the potential of being over dependent on technology are being faced. Some educators feared an overreliance on AI might kill students' creativity, while others stressed the irreplaceable nature of human interaction in developing social and emotional skills.

The analysis also highlights the importance of teacher professional development programs in



developing capability to use AI tools effectively. Respondents expressed a significant interest in training, indicating a disconnect between the promise of AI and educators' ability to take advantage of those possibilities. One factor that arose with many teachers was institutional support for implementing AI, with teachers reporting that their universities promoted use of AI but also cited financial and accessibility challenges, especially for teachers in public schools.

The findings offer actionable insights for policymakers seeking to design equitable AI integration strategies, particularly in resource-constrained settings. For educators, the data highlights the need for targeted professional development to bridge gaps in AI literacy and confidence (Yuwono et al., 2024). Institutions can leverage these results to prioritize infrastructure investments and address cost barriers, ensuring inclusive adoption. Additionally, the study underscores the importance of balancing technological innovation with pedagogical values, advocating for frameworks that preserve teacher autonomy while harnessing AI's efficiency (Nguyen et al., 2023). Ultimately, this research serves as a foundation for evidence-based decision-making, fostering sustainable implementation of AI in education without compromising ethical or human-centric principles.

From the future perspective, by focusing on ethics, accessibility and teachers' preparedness, the research indicates AI importance for higher education future in Pakistan. Policymakers, educators, and technologists need to come together and develop structures for innovation in such a fashion that it does not leave a majority behind with respect to AI being a force among equals as opposed to creating a greater divide. A human-centred perspective is more necessary than ever, with technology adding to rather than replacing the emotional intelligence, creativity, and moral urgency that are the foundations of great teaching and learning. In summary, although AI has great potential to transform education, it must be successfully implemented while addressing systemic issues, empowering teachers, and keeping the focus on equity and ethics. This way, we can transform the system of education to adhere to the requirements of a digital world, maintaining humanistic principles in teaching and learning.

Future Directions and Policy Implications

The World Economic Forum's Future of Jobs Report underscores the growing demand for skills like critical thinking, problem solving, and adaptability areas where human educators excel (Holmes, 2020). To prepare for this shift, teacher-training programs must emphasize digital literacy and ethical AI integration (Yuwono et al., 2024). Policymakers must also address the digital divide, ensuring AI serves as an equalizer rather than exacerbating existing inequalities (Umar, 2024).

The future of AI in education relies on responsible innovation, as new trends such as AI-enabled VR classrooms, emotion-sensing tutors, and block chain credentialing are reshaping the learning experience (Xia et al., 2024). To make sure that all students benefit from these advances, policymakers will need to take action. First, AI literacy could be integrated into teacher training programmes to support teachers to use AI in their classroom (Yuwono et al., 2024). Second, equity-oriented practices and policies (e.g., subsidies for access to technology in underserved areas) are critical in addressing digital divide (Umar, 2024). Lastly, there needs to be a robust ethically grounded structure to AI such that our AIs are transparent, unbiased, and guard students' data (Xiaoyong et al., 2023). By focusing on these priorities, AI could be used to improve education inclusively and ethically.

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